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(54) Title: CHARGING FOR AN IP BASED COMMUNICATION SYSTEM
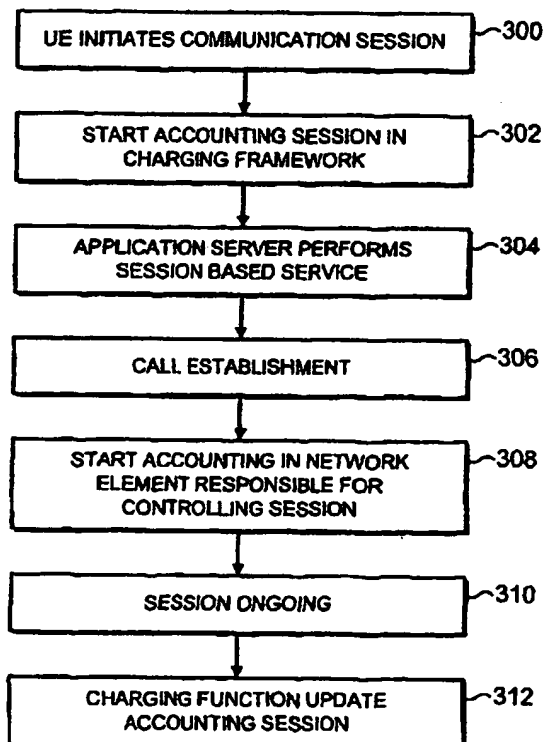
(57) Abstract: There is disclosed a method for charging for services in an IP based communication system, comprising: establishing an accounting session between a network element and a charging function for the session; and initiating a change in the accounting session at the charging function.

UE INITIATES COMMUNICATION SESSION — 300

START ACCOUNTING SESSION IN CHARGING FRAMEWORK — 302

APPLICATION SERVER PERFORMS SESSION BASED SERVICE — 304

CALL ESTABLISHMENT — 306

START ACCOUNTING IN NETWORK ELEMENT RESPONSIBLE FOR CONTROLLING SESSION — 308

SESSION ONGOING — 310

CHARGING FUNCTION UPDATE ACCOUNTING SESSION — 312

WO 2004/015975 A1

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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CHARGING FOR AN IP BASED COMUNICATION SYSTEM

FIELD OF THE INVENTION

The present invention relates to the provision of charging services in Internet protocol networks, and particularly to the
5 updating of accounting sessions during charging.

BACKGROUND OF THE INVENTION

The provision of centralised charging functionality is likely to be a key issue in all-IP (Internet protocol) networks, such as mobile communications networks in which a packet switched
10 cellular network provides access for mobile users to services provided by external IP networks.

Diameter is an IETF protocol that has been specifically designed for the Internet infrastructure. Diameter unifies authentication, authorization and accounting (AAA)
15 transactions. The accounting related extension of the base Diameter protocol is likely to be used in networks which are all-IP (Internet Protocol) based for charging purposes.

An essential feature of the provision of charging functions in all-IP based networks is that on-line charging must be provided
20 for, which may require for the information associated with an accounting session to be updated dynamically. However, the existing Diameter protocol does not specifically allow for on-line charging capability.

It is an object of the present invention to provide an improved
25 technique for charging in IP networks, which addresses one or all of the above-stated problems.

SUMMARY OF THE INVENTION

According to the present invention there is provided a method for charging for services in an IP based communication system,
30 comprising: establishing an accounting session between a

network element and a charging function for the session; and initiating a change in the accounting session at the charging function.

The step of initiating a change in the accounting session may
5   comprise transmitting a request to update the accounting session from the charging function to the network element.

The request may be an update accounting request message. Responsive to the request the network element may implement a change in the charging of the accounting session.

10 Responsive to the request the network element may transmit an acknowledgement to the charging function. The acknowledgement may be an update accounting acknowledgement message.

The network element may be a controller of the communications session.

15 The step of establishing an accounting session may include establishing an accounting session between the charging function and a further network element.

The method may further comprise the step of establishing an accounting session between an application for the session and
20 the charging function.

The method may further comprise the step of establishing an accounting session between a control function for the session and the charging function.

The change in the accounting session between the network
25 element controlling the session and the charging function may be responsive to a change in the at least one further accounting session.

The accounting session may be associated with a pre-paid charging function.

The IP based communication system may support a Diamater IP protocol.

According to a further aspect of the present invention there is provided an element for monitoring charging in an IP based communication system, comprising: means for establishing an accounting session with an application; means for informing a network element controlling an associated communication session of the accounting session; and means for initiating a change in the accounting session.

The means for initiating a change in the accounting session may include means for transmitting a request to update the accounting session.

The request may be an update accounting request message.

A change in the charging of the accounting session may be implemented responsive to the request.

Responsive to the request the network element may transmit an acknowledgement to the charging·function.

The acknowledgement may be an update accounting acknowledgement message.

The network element may be a controller of the communications session.

The communication system may support a Diameter IP protocol.

The request signal may be transferred using a Diameter IP protocol. The acknowledgement signal may be transferred using a Diameter IP protocol.

According to a still further aspect of the present inven tion there is provided a communication system in which charging for the provision of services is implemented in a session, the system comprising: a network element for controlling the session; an application for the session; a control function for

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the session; and a charging function, wherein at least one
accounting session is established between the charging function
and at least one of the network element, the application and
the control function, wherein the charging function is adapted
5 to initiate a change in the at least one accounting session.

The charging is preferably pre-paid charging.

There is preferably provided a plurality of accounting
sessions, wherein the charging function initiates a change in
one accounting session responsive to a change in another
10 accounting session.

In summary, therefore, in embodiments the present invention
provides an enhancement to the Diameter IP protocol's on-line
charging capability, by specifying a new message pair for
charging information updating purposes. This new message pair
15 is, in a preferred embodiment, a charging function server
initiated update-accounting-request, and a corresponding
update-accounting-answer.

Advantageously, the present invention enables effective on-line
charging in all-IP networks. The charging function server is
20 adapted to update an accounting session dynamically. Especially
advantageously, the Diameter protocol is adapted to enable more
flexible charging functionality.

The invention thus provides for an operator to be able to use
the Diameter protocol in a flexible way.

25 BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention and as to
how the same can be carried into effect, reference will now be
made by way of example to the accompanying drawings in which:

Figure 1 illustrates the main network elements in an example
30 implementation of the present invention;

Figure 2 illustrates the signaling in a preferred embodiment of the present invention; and

Figure 3 is a flow chart illustrating the principle steps in implementing the preferred embodiment of Figure 2.

5   DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is described herein with reference to a particular illustrative embodiment. However, such embodiment is presented for the purposes of illustrating the present invention, and does not limit the scope thereof.

10   In particular, the present invention is described herein with reference to a particular example of a UMTS network supporting user equipment, such as a mobile station, and providing connections for the user equipment to external IP networks.

Referring to Figure 1, there is illustrated the main elements
15   of a UMTS network implementing an all-IP Diameter protocol system for the purposes of describing the present invention. In Figure 1 only those elements of a UMTS system necessary for supporting the Diameter protocol charging in accordance with the present invention are illustrated. The full implementation
20   of such a system will be apparent to one skilled in the art.

Figure 1 illustrates generally a UMTS network infrastructure 10 including a serving GPRS support node (SGSN) 3, a gateway GPRS support node (GGSN) 5, a serving call state control function (S-CSCF) 4, a charging framework (CF) 8 preferably including a
25   combined charging collector function (CCF) and online charging system (OCS), and an application server (AS) 6. The SGSN 3 provides access over the radio access network 7 for a user equipment 2 to the UMTS network 10. The SGSN 3 is connected to the GGSN 5 by a link 9. The GGSN is connected to the S-CSCF 4
30   by a link 17. The SGSN and the GGSN represent the packet domain of the network 10 of Figure 1. They provide control and

transfer of packets between the UE 2 and applications provided in the network 10 or in other external networks.

The S-CSCF 4 supports a call session for the user equipment, such as user equipment 2, connected in the UMTS network 10. The
5   CF 8 provides the centralized charging function for on-line and off-line charging, and is connected to the S-CSCF 4 by communication link 13. The CF 8 is additionally connected to the GGSN 5 and the AS 6 by respective communication links 11 and 19. The AS 6 is connected to the S-CSCF 4 by communication
10 links 15.

It should be noted that the elements and connections shown in Figure 1 are for the purposes of illustrating an exemplary embodiment of the invention only, and one skilled in the art will fully understand the implementation of a UMTS network 10.

15 The S-CSCF 4 additionally has a connection 12 to an IP network or element of an IP network external to the UMTS network 10, as described further hereinbelow. In particular, the connection 12 connects to a service provider or terminating part with which the user equipment 2 establishes a session.

20 The UMTS network provides access to other, external IP services or networks for the user equipment 2. For the purposes of the present example, it is assumed that a call session is to be established between the user equipment 2, and a B-subscriber 22 in a further IP network 18. The further IP network 18 supports
25 the call session for the B-subscriber 22 with a serving call state control function (S-CSCF) 20. For the purposes of this example, as the initiating caller the user equipment 2 is considered to be an A-subscriber. For the purposes of supporting the call session, the connection 12 is between the
30 respective S-CSCFs of the respective subscribers.

The B-subscriber may, for example, be a further user equipment or a service provided by a third party.

The protocol interfaces for the various IP network elements of Figure 1 may be implementation dependent. In a preferred embodiment the S-CSCF 4 is connected to the AS 6 via an ISC interface. The ISC interface may, for example, be a session initiation protocol (SIP) interface. The CF 8 is preferably connected to the S-CSCF 4 via a Diameter protocol represented. The CF 8 is preferably connected to the AS 6 via a diameter protocol.

Referring to Figures 2 and 3, an example embodiment of the present invention is now described.

In a first step, user equipment 2 transmits an INVITE message 100 in the packet domain - as represented by block 101 - to the serving call state control function (S-CSCF) 4 allocated to the call session. In Figure 2, the packet domain 101 represents the SGSN 3 and the GGSN 5. The communication of signals through the packet domain is well-known to one skilled in the art. The INVITE message represents the initiation of an active communication session by the UE 2, as represented by step 300 in Figure 3, which requires an accounting session to be initiated to charge the session.

Responsive to the INVITE message, in the preferred embodiment an initial accounting is started by the S-CSCF 4. The S-CSCF sends an ACR(START_RECORD) accounting request message 102 to the CF 8. The CF 8 replies with an ACA accounting acknowledgement message 103. If the user equipment 2 is a pre-paid user, an initial threshold value is also sent to the S-CSCF 4 by the CF 8. The start of the accounting session is represented by step 302 in Figure 3.

As such, a first accounting session is established with the charging function.

Following the start of the initial accounting, the S-CSCF 4 transmits an INVITE message 104 to the AS 6. Responsive to the
5   INVITE message 104, the AS 6 preferably performs a session based service as represented by step 304 in Figure 3. To perform the session based service, the AS 6 sends an accounting request ACR(START_RECORD) message 106 to the CF 8. Responsive thereto, the CF 8 replies with an ACA accounting
10   acknowledgement message 107.

As such, a second accounting session is established with the charging function.

The session based service may be a one-time event, for example this ACR may include any sponsorship information, where the AS
15   6 confirms its identity and also that it will pay a percentage, or a predetermined fixed amount, of certain charges. For example, the AS 6 may inform the CF 8 that it intends to pay for 50% of the Call Control charges and 50% of the mobility management charges, as charged by the S-CSCF 4. The CF 8 stores
20   this information, and then replies with the ACA accounting acknowledgement message 107.

Thereafter, the AS 6 returns an INVITE message 108 to the S-CSCF 4. The S-CSCF 4 then forwards an INVITE message 110 towards the terminating party (the B-subscriber 22), i.e. the
25   recipient of the call session initiated by the user equipment 2.

Responsive to satisfactory acceptance of the call, in accordance with known techniques, the terminating party returns a positive acknowledgement message to the S-CSCF 4, which
30   message may be a 200 OK message. Such message is not shown in Figure 2, and will be familiar to one skilled in the art.

Thereafter, a final session data protocol (SDP) takes place between the CF 8 and the UE 2, as represented by message 111. A secondary PDP context then takes place in the packet domain, as represented by block 113. The secondary PDP context is well-known to one skilled in the art.

5

The transmission of the final SDP 111 and the activation of the second PDP context 113 complete the establishment of the call between Subscriber A (UE 2) and Subscriber B 22. This is represented in Figure 3 by step 306.

10 Thereafter, an accounting session is initiated from the GGSN 5 in the packet domain 101, as represented by step 308. In this example the GGSN 5 is the network element (NE) responsible for controlling the session. In alternatives, the network element controlling the session may, for example, be an application

15 server such as AS 6 or an IP multimedia subsystem (IMS).

The accounting session is initiated by the GGSN sending an ACT(START_RECORD) message 114 to the CF 8. The CF 8 replies with an ACA accounting acknowledgement message 116.

As such, a third accounting session is established with the

20 charging function.

The ACA message 116 may include the new tariff. In a pre-paid user scenario, an initial threshold value is sent from the CF 8 to the GGSN 5.

Thereafter a 200 OK message 118 is transmitted through the

25 network from the terminating network 18 to the UE 2, to indicate that the session could be established.

Thereafter, as represented by step 310 in Figure 3 and communication 120 in Figure 2, a communication session is ongoing in which the cost thereof is monitored by the CF 8.

Once the session is established and ongoing, in accordance with the present invention the CF 8 may dynamically change the charging capabilities of the session.

In the example of Figure 2, at some time after the session has
5 begun the CF 8 detects that after a certain time (e.g. after the session has been ongoing for one hour), the use of the packet domain is free for the particular application server being used. As such, the CF8 sends a UAR (update-accounting-request) message 122 to the GGSN 5. The UAR message 122
10 indicates to the GGSN 5 that the accounting session is free of charge from this point onwards.

Responsive to the UAR message 122, the GGSN 5 returns a UAA (update-accounting-answer) message 124 to the CF 8, to acknowledge that the UAR message 122 has been received and
15 acted on. The change to the charging capabilities of the network is indicated by step 312 in Figure 3.

It should be noted that the update could be performed also towards the S-CSCF 4 and/or the AS 6.

Thus the present invention provides for the dynamic change of
20 the accounting session on the initiation of the charging function, particularly in a network utilizing a Diameter protocol for charging.

The present invention particularly advantageously may be applied in prepaid charging scenarios. A charging function or
25 framework may support pre-paid charging for GPRS or 3G access and for access to the IP multimedia subsystem (IMS). The invention allows the charging function or framework to inform the network element controlling the session if charging parameters are changed at some point in the session.

30 There are various different bases on which the charging parameters may be changed. For example the service provider may

increase or decrease some part of the session charge at some stage during the session. This may be because the session has exceeded a certain length of time or cost, or the time of day is such that revised charging costs are in force. Possible

5 alternatives for causing the charging function or framework to vary the cost of the charging session will be readily apparent to one skilled in the art.

The invention advantageously provides a mechanism for flexible and effective on-line charging in all-IP networks. As the CF is

10 the only node which can combine independent accounting sessions related to the same session, the CF initiated updating mechanism offers an important service.

In the preferred embodiment, the invention provides for a new message pair in networks implementing charging using the

15 Diameter protocol. The message pair comprises an updating accounting request (UAR) from the charging function or framework, and a corresponding update accounting answer (UAA) to the charging function or frame work. This enables the Diameter protocol to be effectively used for on-line charging

20 in all-IP networks.

The need for such an ability for the charging function or charging framework to provide dynamic adjustment of the charging parameters is especially applicable in scenarios where accounting sessions have interaction. In such scenarios, one

25 session may provide another with information about a change in its charging.

In the example of Figure 2, for example, three accounting sessions are established, as represented by steps 302, 304 and 308.

30 The invention may preferably be utilized for on-line charging.

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The present invention is described herein with reference to examples of preferred embodiments for the purpose of illustration, and is not limited to any such embodiments. The scope of the present invention is defined by the appended
5   claims.

CLAIMS

1. A method for charging for services in an IP based communication system, comprising: establishing an accounting session between a network element and a charging function
5   for the session; and initiating a change in the accounting session at the charging function.

2. A method according to claim 1 wherein the step of initiating a change in the accounting session comprises transmitting a request to update the accounting session from the charging
10   function to the network element.

3. A method according to claim 2 wherein the request is an update accounting request message.

4. A method according to claim 2 or claim 3 wherein responsive to the request the network element implements a change in
15   the charging of the accounting session.

5. A method according to any one of claims 2 to 4 wherein responsive to the request the network element transmits an acknowledgement to the charging function.

6. A method according to claim 5 wherein the acknowledgement is
20   an update accounting acknowledgement message.

7. A method according to any one of claims 1 to 6 wherein the network element is a controller of the communications session.

8. A method according to any one of claims 1 to 7 wherein the
25   step of establishing an accounting session includes establishing an accounting session between the charging function and a further network element.

9. A method according to claim 8 further comprising the step of establishing an accounting session between an application
30   for the session and the charging function.

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10. A method according to claim 8 or 9 further comprising the step of establishing an accounting session between a control function for the session and the charging function.

11. A method according to claim 9 or claim 10 wherein ·the
5   change in the accounting session between the network element controlling the session_ and the charging function is responsive to a change in the at least one further accounting session.

12. A method according to any one of claims 1 to 11, wherein
10   the accounting session is associated with a pre-paid charging function.

13. A method according to any one of claims 1 to 12 wherein the IP based communication system supports a Diamater IP protocol.

15   14. An element for monitoring charging in an IP based communication system, comprising: means for establishing an accounting session with an application; means for informing a network element controlling an associated communication session of the accounting session; and means for initiating
20   a change in the accounting session.

15. An element according to claim 14 wherein the means for initiating a change in the accounting session includes means for transmitting a request to update the accounting session.

16. An element according to claim 15 wherein the request is an
25   update accounting request message.

17. An element according to claim 15 or claim 16 wherein a change in the charging of the accounting session is implemented responsive to the request.

18. An element according to any one of claims 15 to 17 wherein responsive to the request the network element transmits an acknowledgement to the charging function.

19. An element according to claim 18 wherein the acknowledgement is an update accounting acknowledgement message.

20. An element according to any one of claims 14 to 19 wherein the network element is a controller of the communications session.

21. An element according to any one of claims 14 to 20 wherein the communication system supports a Diameter IP protocol.

22. An element according to claim 21 when dependent upon claim 15, wherein the request signal is transferred using a Diameter IP protocol.

23. An element according to claim 21 when dependent upon claim 18, wherein the acknowledgement signal is transferred using a Diameter IP protocol.

24. A communication system in which charging for the provision of services is implemented in a session, the system comprising: a network element for controlling the session; an application for the session; a control function for the session; and a charging function, wherein at least one accounting session is established between the charging function and at least one of the network element, the application and the control function, wherein the charging function is adapted to initiate a change in the at least one accounting session.

25. A communication system according to claim 24 wherein the charging is pre-paid charging.

26. A communication session according to claim 24 or claim 25 wherein there is provided a plurality of accounting sessions, wherein the charging function initiates a change in one accounting session responsive to a change in another accounting session.
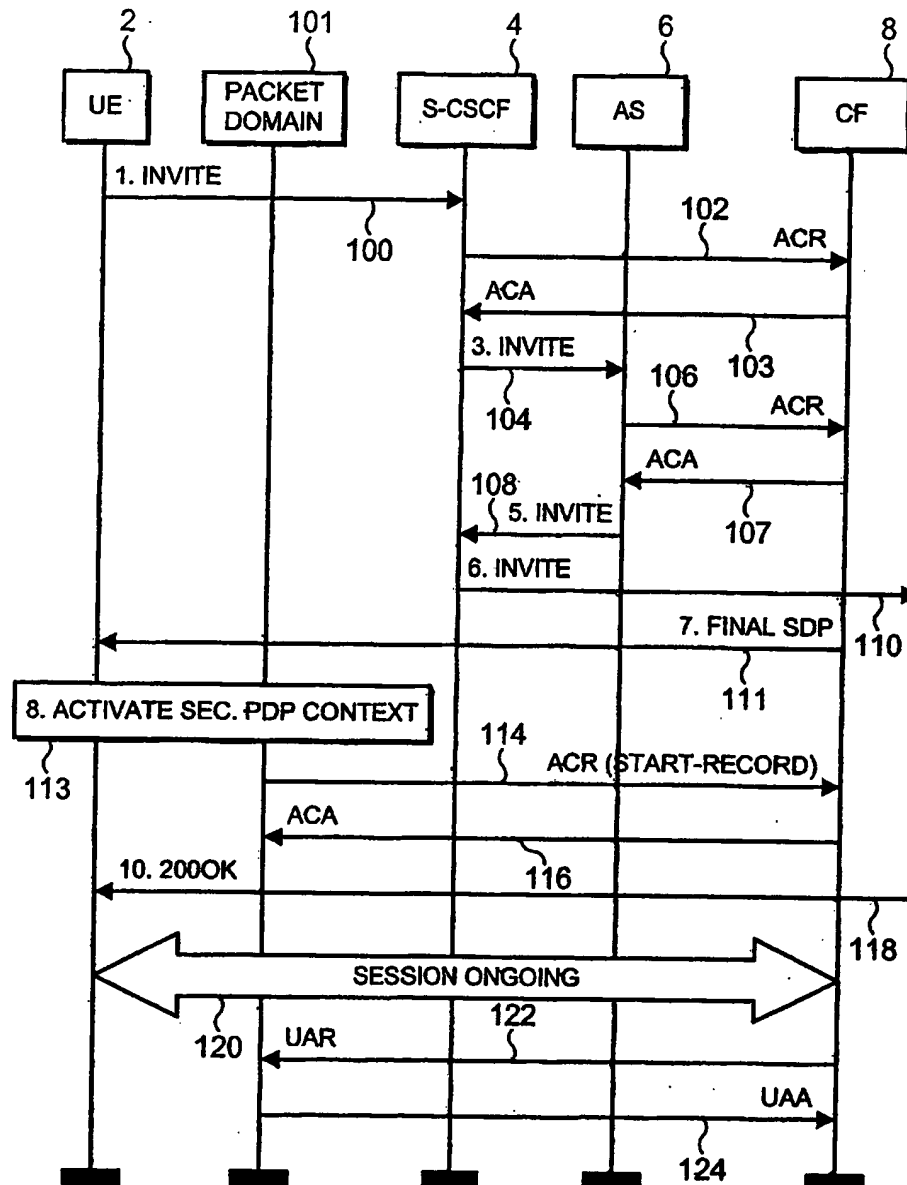
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FIG. 1

FIG. 2

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┌─────────────────────────────────────┐
│ UE INITIATES COMMUNICATION SESSION   │──300
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│   START ACCOUNTING SESSION IN        │──302
│      CHARGING FRAMEWORK              │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│   APPLICATION SERVER PERFORMS        │──304
│      SESSION BASED SERVICE           │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│        CALL ESTABLISHMENT            │──306
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│   START ACCOUNTING IN NETWORK        │──308
│    ELEMENT RESPONSIBLE FOR           │
│     CONTROLLING SESSION              │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│        SESSION ONGOING               │──310
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│   CHARGING FUNCTION UPDATE           │──312
│      ACCOUNTING SESSION              │
└─────────────────────────────────────┘
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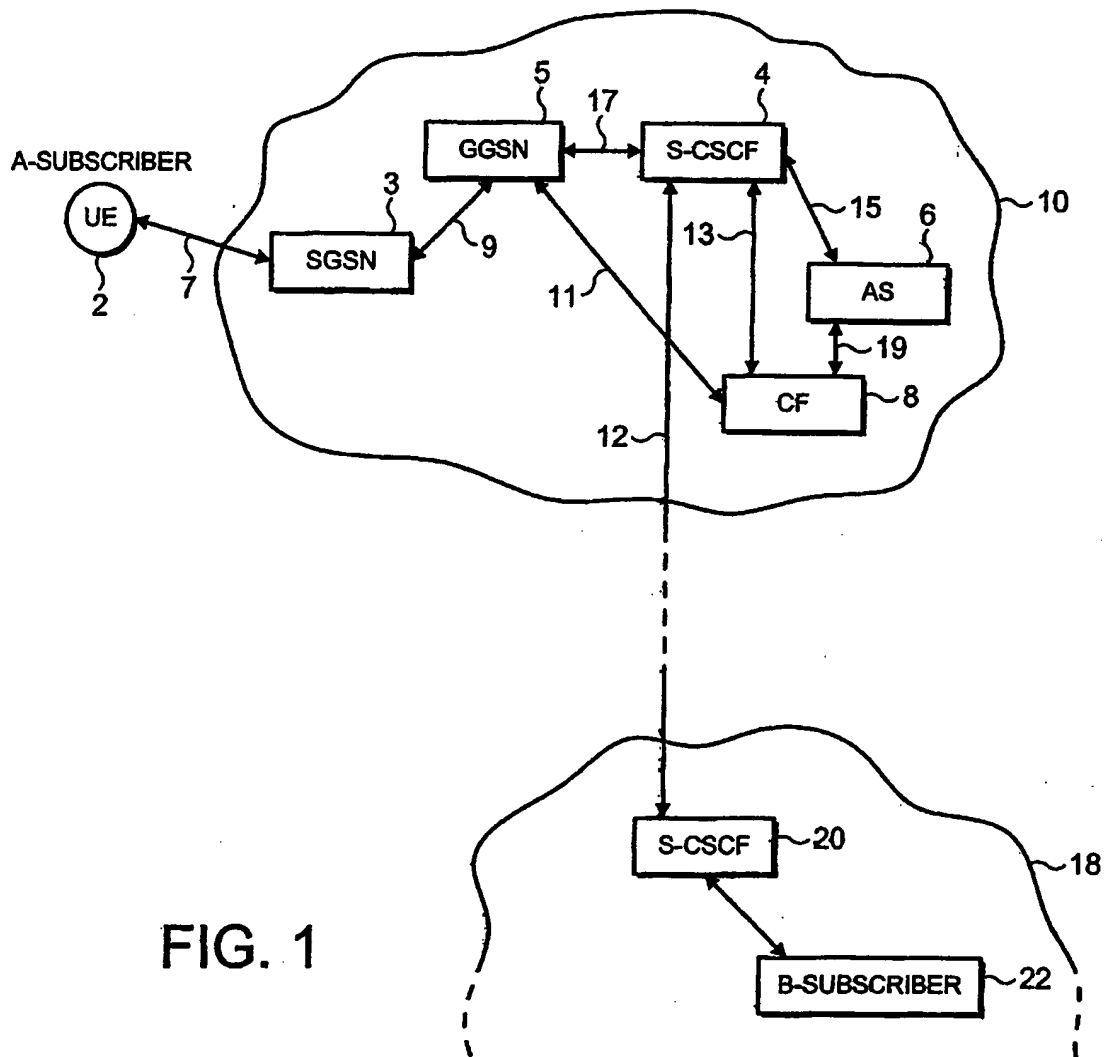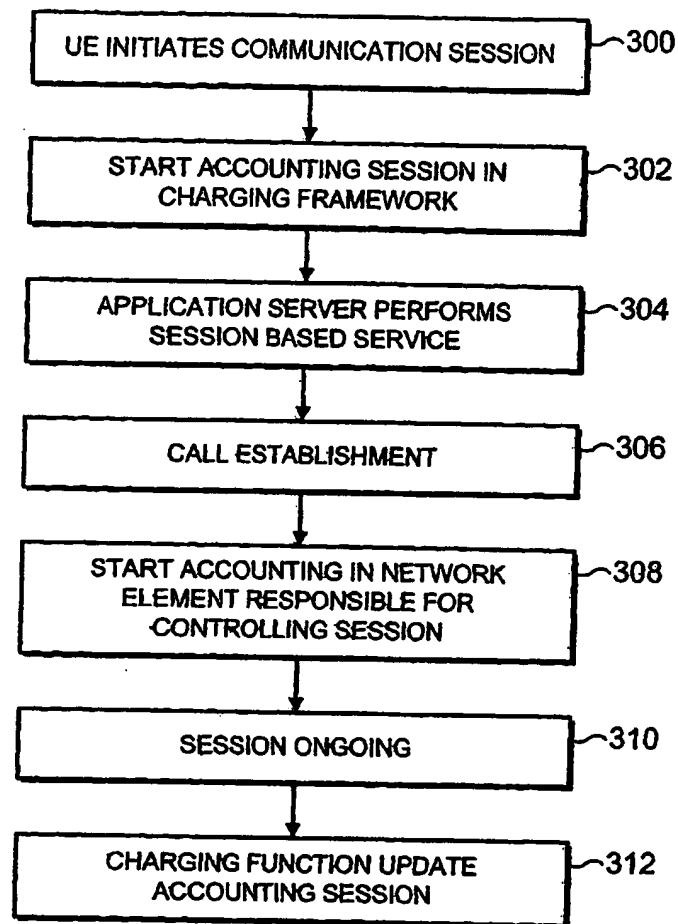
FIG. 3

INTERNATIONAL SEARCH REPORT

Int   ation No
PCT/IB 02/03871

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04M15/00   H04L29/00   H04L12/14   H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y		2-13, 15-23, 25,26
X	US 2001/049656 A1 (ROSLOF JANNE ET AL) 6 December 2001 (2001-12-06) column 2, line 23 -column 4, line 20 abstract; figures 1-4	1,14,24
	-/--	

| X | Further documents are listed in the continuation of box C. | | X | Patent family members are listed in annex. |

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 March 2003	10. 04. 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Behroz Moradi

Form PCT/ISA/210 (second sheet) (July 1992)

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	---	13,21-23
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